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Title: Report on Peregrine Falcon Eyrie R-30 in 2012

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**Report on peregrine falcon eyrie R-30 in 2012**

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**Background:** Lower Pueblo Canyon has been used by peregrine falcons (Falco peregrinus) at least since 1964 for nesting and as a core territory. The falcons hunting territory is extensive and has been documented to include Los Alamos National Laboratory land. This eyrie has been monitored by LANL since the early 70s to ensure compliance with environmental laws and for basic peregrine falcon biology. The species remains on the New Mexico Endangered Species List and is protected as a migratory bird (Hathcock 2011). An event at the eyrie in 2012 was so unusual that this report was warranted.

**Methods:** Four volunteer observers, all LANL employees, monitored the canyon. Falcon activities were observed from the south rim of the canyon with the aid of binoculars up to 10x, spotting scope up to 80x, and cameras with lenses up to 1000mm. Presence, behaviors, and events were noted and posted to a shared web database. Occasionally falcon presence was determined after the physical visit by examination of digital photographs. The eyrie cave used in 2012 was compared to historical records marked on photographs by the author. Access to the talus slope was by foot for search and recovery of falcons and falcon debris, and the eyrie and a crevasse below it were accessed by standard mountaineer rappelling. For collections, the author was a sub-permittee under Terrell Johnson's Federal and State permits. Collection of eggshell fragment and eyrie debris was by hand, and by scooping the top 2 cm of regolith with a straight edged scoop over an approximately 0.1 $m^2$ area surrounding the scrape where the clutch had been observed.

**Biological Chronology:** Both adults were present March 5$^{th}$, beating the previous adult male earliest arrival date by 6 days, and beating the previous adult female arrival date by 12 days. Cave visitation was first observed March 13$^{th}$. Several caves were visited by the pair in the core territory that is above and left of the prominent group of Indian cavates at the base of the cliff. An eyrie cave was selected in early April, which had not been used previously by any peregrine falcons, other raptors, or ravens at least since 1964. Based on high incubating posture on April 9$^{th}$, the egg-laying date was estimated as April 7$^{th}$. On May 3$^{rd}$, four eggs were observed by spotting scope, two being the typical chocolate brown color, and two were off-white in color. On May16$^{th}$, three hatchlings were seen being fed, estimated to be 1 to 2 days in age based on size, 2 days old based on 35 days from the start of incubation. The 4$^{th}$ egg/hatchling was not again seen. The young developed normally through the morning of June 4$^{th}$. After that time, failure was suspected and then confirmed, with all young knocked out of the eyrie and only one surviving. The survivor was rescued, June 6$^{th}$, one dead nestling was found at that time, and the other found July 14$^{th}$. Observations the evening of June 6$^{th}$ saw both adults flying together near the south rim, but on the evening of June 7$^{th}$ no adults were detected in the canyon. The adults likely stayed in the area but observations were discontinued.

**Human activities:** A contractor to the County of Los Alamos continued with a natural gas

pipeline installation along the top of Kwagee mesa that was begun before the arrival of the falcons. Observers could not see the activities from the south side of the canyon, and the falcons could only have seen the activity when flying higher than the mesa top. Part of this project was a trench up the talus slope to the base of the cliff near the wastewater treatment plant for connection to a vertical shaft drilled from the mesa top. This operation was out of sight of the core territory due to a ridge in the talus slope and no disturbance was observed. Routine operations continued at the County wastewater treatment plant at the bottom of the canyon.

Mountain bikers were seen on one occasion on the pipeline road at the base of the talus slope with no detectable reaction from the falcons. This dirt road has been used regularly in past years by hikers and joggers, especially on weekends, without reaction from the peregrines, thus there appears to be some habituation to such activity. During certain stages of the nesting cycle, such as fledging of young, the falcons have in the past shown increased sensitivity to activity below the eyrie. During the recovery of the live and dead nestlings and searching the upper portion of talus slope for clues, both adults flew overhead and made vocal protests for most of the recovery period.

**Actions/Findings:** The courtship, egg laying, incubation, and care of the three young were normal, and no Laboratory or other human activities were observed that caused behavior change or other disturbance. There was uncertainty beginning May 31$^{st}$ about the presence and number of nestlings because of recesses on the sides of a very open eyrie cave. Once the nestlings were ambulatory, they favored the recesses, especially on the left, but could occasionally be seen. Therefore spotting scope observations could not easily assess number of young, and did not determine a declining number. Three nestlings were last confirmed to be in the eyrie on the evening of June 3$^{rd}$, not attended by adults, which is normal for nearly 3 weeks of age. On the morning of June 4$^{th}$ one nestling was seen in the eyrie, moving actively, and the others were assumed to be out of sight. Three hours of observation on the evening of June 4$^{th}$ by three overlapping observers saw no nestling. The adult female landed twice on the front ledge with a prey item (same item both times), but was not greeted by the young, which is unusual. The prey was not left. On the evening of June 5th, 2 hours and 43 minutes of observation by a single observer did not see young in the eyrie, and saw both adults pass by the eyrie without landing. On June 6$^{th}$ in the early morning, a live nestling was spotted on the talus slope below the eyrie, indicating an apparent predator attack on the eyrie. The adults brought food to this nestling. Additional observers headed to the site immediately to look for cause, and Hira Walker (NMFG&F non-game ornithologist) was contacted about recovery of the live nestling. She agreed that a prematurely fledged flightless young was extremely vulnerable to predation, even if fed by adults. Returning the nestling to the eyrie was considered, but at that time great-horned owl predation was the leading hypothesis of cause, and previous history of repeat attacks by conditioned great-horned owls indicated a low chance of survival. Also, returning the nestling to the eyrie cave before the adults lost affinity to the eyrie would require immediate execution, but the logistics were formidable as the eyrie is about175 feet down a 275 foot cliff. Walker directed that the nestling be taken to The Wildlife Center in Espanola for evaluation, with the intention of eventual release. The dead nestling found on the talus slop was also delivered to the Wildlife Center for evaluation.

The first photo below is of the surviving nestling as found on the talus. Meat on the beak is from

recent feeding by the parents. Gender is male. The nestling was feisty, showing no signs of injury, and no external parasites. The eyrie is about 100 feet above the talus and the wing primary feathers were showing barely more than an inch of opened feather, very little for air resistance, thus its survival was remarkable. It was about 30 feet from the base of the cliff and had not moved any significant distance between being spotted at 6:30 AM and the recovery about 8:30 AM. Its impact might have been lessened if it hit a clump of grass or a spindly bush.

The dead nestling found on the talus is shown in the bottom photo. This nestling was underneath a fallen dead piñon pine, and some down feathers and colored pinfeathers were scattered to one side. Possibly it impacted the piñon wood, causing fatal injury and scraping off some down and feathers. It was on its belly with feet underneath as if it lived for some time and tried to gather itself up. The wing primary feathers were showing less than an inch of opened feather. At 8:35 AM, the carcass had no insects on it or the ground underneath, was cold to the touch, and had a slight odor of decay. Searches of the upper portion of the talus slope were continued east and west and nothing else was found, including no evidence of a predator. The live bird and carcasses were collected and taken to The Wildlife Center in Española.

On July 14, the eyrie cave was accessed. The floor of the cave had regolith a few inches deep on the right side where the egg scrape had been made, and sloping rock leading up to the left side with some shallow regolith. Various feathers were caught in some small rocks at the front center of the eyrie and in a notch just below the front center. Eggshell fragments and dry clusters of avian fecal matter and urate were visible in the regolith, typical spots and streaks of white urate were in various places.

Dimensions of cave are: mouth width 78", mouth height on left 44", mouth height on right 42", horizontal depth on left 31", horizontal depth on right 34", interior width 108", interior height on left 47", interior height on right directly above scrape 34". This cave is larger and more open than typical caves used at this site, but still provides good shelter from weather.

Regolith collection amounted to 2 pounds. Eggshell fragments will be sorted out and measured as part of an ongoing study of eggshell thickness.

Feathers were collected from the rocks and notches at the front, except those too deep to reach with fingers, and on examination, all are from passerines that were likely peregrine prey (no predatory species).

The cliff surface forms a funneling chute leading to a crevasse directly below the eyrie, thus it had been identified as a likely place for evidence. A dead peregrine nestling was on the regolith-covered level floor of the crevasse. It was laying on its right side, lower legs and feet visible and extended towards the tail feathers. The initial impression is that it died on impact or before as it did not seem to collect itself before dying, as did the other dead nestling found on the talus slope. Downy feathers, pinfeathers and flight feathers were intact on the topside; the flesh and underside was very decomposed (38 days since death), lower legs and feet were desiccated, and various carrion insects were present. The carcass was collected for further examination. The state of decomposition obscured any injuries that might have come from a predator, such as a puncture. Tail feathers were 31 mm out of the sheath, primaries were 33 mm out of the sheath,

which is similar to the other two nestlings. Flight feathers were all present. The feet seemed small, possibly influenced by the desiccation. Left tarsus bone length 59.0 mm, right tarsus bone length 58.7 mm (size suggests female), estimated cere edge to beak tip 13.85 mm, skull intact except lower mandible slightly offset, leg bones and wing bones unbroken.

Two medium sized eggshell fragments were on the surface of the crevasse floor, and were collected. A few prey feathers were also visible.

Summary of findings on nestlings that fell from the eyrie

| ID | Weight, g | Tarso-metatarsus bone length, mm | Gender | Foot, hallax to middle digit, mm | Results of examination |
|---|---|---|---|---|---|
| PEFA R-30 12-001 | 530 | 43.56 | M | 76.03 | 8PM 6/6 Wildlife Center reports: [Dead] "Many maggots have already set in and eaten holes in carcass. [Timing indicator, see text.] There appears to be trauma/bruising encompassing the entire crop along with a couple of punctures and trauma to the right shoulder although it is possible some of this comes from the damage caused by the maggots along with typical post mortem decay." |
| PEFA R-30 12-002 | 431 | 46.89 | M | 81.24 | 6/6 Wildlife Center reports: "No injuries, responding well to food." |
| PEFA R-30 12-003 | n/a | L, 59.0<br>R, 58.7 | F | n/a | Author's examination: Dead, extensive decomposition. Death occurred on or before 6/6 from trauma from impact or unknown predator. |

**Assessment/Conclusions:** Courtship, nest site selection, egg laying and the early nestling phase were normal. The 4$^{th}$ egg most likely hatched and the nestling died before being detected, as unhatched eggs generally remain in the eyrie at least until the nestlings are large enough to break it inadvertently or knock it out of the nest (Ponton 2010). Removal of the carcass of a nestling that dies soon after hatching by adults is possible, but there is little information on what they might do with the removed carcass. Terrell Johnson, a peregrine observer with over 30 years experience observing eyries throughout New Mexico, once observed an adult peregrine placing a dead nestling to the side of an eyrie ledge, away from the remainder of the brood, but did not observe what next happened to the carcass (Pers. comm.). In Ireland, Treleaven (op. cit.) has observed adults eating dead nestlings. The early loss of the 4$^{th}$ egg/young is not related to the later loss of all the young.

The stage where failure was occurring but not recognized by the observers is understandable as

the author and others researchers have observed other occasions where the young are seldom seen, and even the feeding by adults cannot be seen (Terrell Johnson, pers. comm.) The lack of sighting of nestlings in the eyrie does not alone indicate failure, and failure of adults to visit the nest for long periods does not indicate failure, as the behavior is common when nestlings are 3 weeks of age. An adult landing at the eyrie multiple times with prey and not feeding young or leaving prey is unusual. A separate study recorded time lapse video of 19 day old nestlings moving to an adult arriving with prey, 20 day old approaching adult arriving without prey, 21 day old beginning feeding within 12 s of pre brought to the eyrie, 22 day old at 1st feeding moving to adult quickly, 2nd feeding grabbing prey from adult within 5 sec of arrival. (Ponton 2010) T. Johnson reports young of this age will rush to a parent arriving with prey. (Pers. comm.)

Timing of incident(s): Although insects were not visible on the first carcass or the ground near it when collected, maggots were detected at the June 6th 8PM post mortem evaluation. The maggot species were not determined. Time for eggs to hatch and larvae to appear varies among species from less than 2 to 5 days. The author has found severe maggot infestation in small peregrine chicks dead less than 2 days elsewhere in the Jemez Mountains during a previous study (Ponton 2010). Thus the time of death was likely prior to the night of June 5/6 (the absence of body heat at 8:35 AM June 6 is consistent but incidental). That nestling appears to have died soon after trauma caused by impact, so it would have fallen from the eyrie between the night of June 3rd and the early the night of June 4th. The former is consistent with the adult not being met by nestlings when visiting the eyrie cave on the evening of June 4th, but not consistent with a single event as at least one young remained in the eyrie on the morning of June 4th. The second carcass was found too late to get any clues as to the time of death. The observations made June 5th were with a spotting scope pointed at the eyrie with a live-view monitor and scans of the cliff by binoculars. The observer did not deliberately scan the talus slope thus any nestlings that might have been there were not detected. At the time of capture on June 6th, there was only a single white urate deposit on the ground next to the nestling, suggesting he was at that point for only a fraction of a day. The nestling did not move from that point during the entire observation time on June 6th, and no other deposits of urates were noticed at another location that he might have moved from, suggesting he might have been displaced from the eyrie the night of June 5th and was there only part of a night and a short while in the morning. For that to be the case, there would have to be at least two displacement incidents. A single incident the night of June 4th wherein two nestlings died would leave the live nestling on the talus for about 36 hours. June 5th was noted to be partly cloudy during the mid-day and a raptor this age can thermo regulate (J. Bednarz, pers. comm.) thus the bird could have survived a day in the open. He had some level of parental support, and could continue his good luck in not being found by a predator. The observers doing the recovery on June 6th saw two coyotes traveling together east along the pipeline at the base of the talus. The author has seen coyotes travel the road south of the streambed on four occasions in the past, so they apparently regularly use an easy travel route, suggesting that the location on the talus slope of the live and dead nestlings could give some isolation from this predator. Turkey vultures are a common scavenger in the area, but were not seen in the immediate area on June 5th or 6th when there was at least one carcass on the ground, and there was no evidence that they fed on the carcass that was in the crevasse for over five weeks, even though the front edge of the crevasse floor was open for access by a flying scavenger.

Three hypotheses have been advanced to explain the findings:

1) A micro burst or other wind event June 4th or early June 5th swept all the nestlings out of the eyrie cave. The wind records at TA53 (LANCE) were obtained for June 4th and 5th. The maximum gust was 16 m/s. The station is 1.5 km to the south, thus a microburst at the eyrie cannot be ruled out. There was no overt evidence of a wind event in Pueblo Canyon or Kwagee Mesa, such as blown down trees. No documentation of weather events sweeping any nestlings from a sheltered cave in a cliff was found. Thus an extreme wind event is considered unlikely, and two extreme wind events separated by 24 hours is not credible.

2) A predator seeking food entered the eyrie the night of June 4th/5th, attacked the nestlings but failed to maintain a hold and knocked the nestlings out of the eyrie. If the live nestling was on the talus after that event, it seems that the adults would have been seen June 5th taking prey to it there, thus there is the possibility of a second predator strike knocking out this nestling. For multiple strikes to fail to take a nestling is less likely than a single strike failing to take prey. No clues as to the species of any predator were found. Common predators in the area such as coyotes and gray fox do not have access up the cliff. Based on previous observations, diurnal avian predators such as red-tailed hawks are easily deterred by the adults. Golden eagles have easy access and a strong record of eyrie attacks suggesting they are not deterred by adult peregrines, but have never been seen at this eyrie in 49 years of observation, were not observed during compilation of data for the Atlas of the Breeding Birds of Los Alamos County, New Mexico (Travis 1992), and were not observed this year by four observers. Several years ago, M. Steinzig observed a kit fox ascending textured portions of this cliff near this eyrie cave, but the last portion of the ascent to the eyrie in question is very shear and likely impossible for a kit fox. (pers. comm.) Ringtails could access any portion of the cliff but have not been encountered at this site and have only a single record of eyrie predation. (White 1962) A long term study in Colorado suggested they are “tolerated” by nesting peregrines (Craig, 2004). Great-horned owls have a history of attacks on peregrine eyries in general and this site in particular, and vocalizations by a male were heard in the canyon in 2012. They have easy access to the eyrie at night, large wings that could knock nestlings out during a strike, when flapping to regain balance or when turning and flying out. Great-horned owls have carried away and consumed juvenile and adult peregrine falcons at this site. (Ponton, 2008) A juvenile great horned owl would be less experienced than an adult. Nestling peregrines will flare their wings and hiss at an attacker, which might deter a juvenile great-horned owl, but the interaction could cause considerable disruption, knocking out some nestlings and causing the owl to fail to maintain a grip on the victim. It should be noted that although nestling peregrine falcons do not jump out of an eyrie to escape a human invader such as a researcher until they are near flight capable, which is over 5 weeks of age, it cannot be assured that three-week old nestlings would not jump out during a scuffle with a predator.

Overall, this predation for food hypothesis is not supported because no food was taken. Some slight enhancement of the scenario occurs in the case of an inexperienced juvenile great-horned owl.

3) A great-horned owl attacked the eyrie for territorial/ecological reasons rather than seeking

food. This occurred one or more times until the eyrie was empty. This hypothesis is consistent with the uncertainty in the number of events, and leaving the remains of two nestlings where they fell and the live nestling on the talus. In the eastern US, loss of released peregrines to great-horned owl predation frequently found that the falcons are not eaten, or only partially eaten (Cade, 1988). There are published but largely anecdotal incidents of other raptor species being killed by great-horned owls for reasons other than food, specifically goshawks (Hawk Watch International, undated) Swainson's hawks (Bednarz, 2010), and ferruginous hawks (Cartron, 2010).

**Summary:** The Los Alamos peregrine eyrie was occupied by an adult pair and the breeding cycle proceeded normally, with one egg or newly hatched young dying, then complete failure when three 21 day old nestling were knocked out of the eyrie but not utilized as food by any predator. Direct evidence of the cause was not found, but a thorough analysis of possible causes was made. The most likely hypothesis is that a great-horned owl attacked the eyrie on one or more nights for reasons other than food seeking, such as territoriality. No disturbance from Laboratory operations or other human activities was observed.

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